



Common Threads Soil Erosion Challenge

Grades 1-4

Learning Objectives: I can...

- Explain why soil is important
- Explain what erosion is
- Explain how erosion is connected to climate change
- Identify and implement strategies that will reduce erosion

Materials

- Plates-1 per group of 3, plus 1 for teacher example
- Soil-from/in the ground for observation, potting soil ok for activity
- Water in a bucket for handwashing
- Water in a separate bucket for activity
- Erosion examples (available in lesson folder)
- Large white board/easel
- White board markers
- Whiteboards-1 per group of 3
- A location with natural materials (leaves, straw, rocks, twigs) that students can collect
- House game pieces

Vocabulary:

- Soil
- Erosion
- Climate
- Climate change
- Downpour
- Mulching
- Cover crop

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Background information for Teacher

Soil erosion is the process that occurs when the impact of water or wind detaches and removes soil particles, causing the soil to deteriorate. **Topsoil**, the top 5 inches of soil and which contains the highest concentration of organic matter and microorganisms, is vital to growing plants (3). The erosion of topsoil is a serious problem for maintaining agricultural land and for water quality concerns (2).

The erosion of topsoil is a great ecological concern because it takes 500-1000 years to form one inch of topsoil naturally (4). Conventional agricultural practices (systematic plowing and replanting of crops) deplete topsoil so a move towards sustainable techniques, like the use of **cover crops** or **no-till farming**, are critical to retaining topsoil for future farming needs.

The impacts of a changing climate are likely to exacerbate this issue. Overall projected climate change events for the Pacific Northwest include increased winter precipitation in the form of rain instead of snow and increased extreme precipitation events (1). These increases in precipitation events are likely to increase rates of erosion.

Sustainable practices that decrease erosion

Cover crops are crops that are generally grown in the off-season (often winter) to increase soil fertility, reduce erosion, and control weeds, pests, and diseases. Cover crops physically slow down the velocity of rainfall before it contacts the soil surface, minimizing soil splashing and runoff. Cover crop root networks help anchor the soil in place. Cover crops in the legume family provide the additional benefit of adding nitrogen to the soil with the help of the special bacteria found in its root nodules (5).

No-till farming (also called **zero tillage**) is a way of growing crops from year to year without disturbing the soil through tillage. Tillage is a process that disturbs the soil, commonly by digging or overturning. No-till practices keep soil structure in place, minimizing erosion.

References

- (1) Borelli, Kristy. "[The Impact of Climate Change on Soil Erosion](http://www.agclimate.net/2015/04/04/the-impact-of-climate-change-on-soil-erosion/)" *Agriculture Climate Network*, 2015. www.agclimate.net/2015/04/04/the-impact-of-climate-change-on-soil-erosion/
- (2) Al-Kaisi, Mahdi. "[Soil Erosion: An agricultural production challenge](http://crops.extension.iastate.edu/soil-erosion-agricultural-production-challenge)" *Iowa State University Extension and Outreach*, 2000. crops.extension.iastate.edu/soil-erosion-agricultural-production-challenge
- (3) Wikipedia contributors. "Topsoil." *Wikipedia, The Free Encyclopedia*. Wikipedia, The Free Encyclopedia, 23 Mar. 2019. Web. 3 Apr. 2019.
- (4) Arsenault, Chris. "[Only 60 Years of Farming Left if Soil Degradation Continues](http://www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/)" *Scientific American*, 2019. www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/
- (5) Wikipedia contributors. "Cover crop." *Wikipedia, The Free Encyclopedia*. Wikipedia, The Free Encyclopedia, 17 Mar. 2019. Web. 3 Apr. 2019.

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Warm-up & Intro

Duration: ~ 25 min.

1. Welcome students to the garden and review garden expectations.
 - *The garden is a classroom, so we will still follow classroom rules*
 - *But it is a special classroom: what are some special rules that we have for the garden, that we don't have in a classroom (don't pick plants without permission, be respectful of animals, use tools appropriately)*
2. Organize students into small groups of 2-4 students. Have **What is soil? Why is it important?** written out in advance on a large whiteboard. Tell students that today they will be learning about soil, why it is important, and ways to help protect it.
3. **What is soil?** (What is it made of). Give students 1-3 minutes to go look at the soil in the garden bed to identify as many things as it is made of. If raining: give them 1 minute to look and return to the circle.
4. Back in the group: Write or draw on whiteboard what you observed in the soil. (Rainy day)
Students share their findings.
NGSS - DCI: Earth's Materials and Systems; DCI: Earth's Natural Resources; DCI: The Roles of Water in Earth's Surface Processes
 - Organize their list of ideas into living and nonliving components. Depending on your age group, you can label these components living/nonliving, biotic/abiotic, organic/inorganic.
 - Soil is made of organic (decomposed from living things) and inorganic (broken down rocks and minerals) material. It holds nutrients and can hold water for plants to use.
5. Have students then brainstorm in their small groups the answer to: **Why is soil important?** Ask them to list or draw the things that we get from the soil.
 - List their ideas to show how many things we need that come from **plants** grown in the soil. (Food, clothing, medicine, paper, building supplies.)
 - Share with students that topsoil, the top 5 inches of soil where most plant growth happens, takes an incredibly long time to be created. 1 inch of topsoil takes about 1000 years to be created.
6. Ask students to give a thumbs up or thumbs down if they have heard the word **erosion**. Write **erosion** on the big whiteboard. Tell students that you are going to show them some examples of erosion (find and print pictures that show erosion and give each group a photo). Rotate the photos around the groups. Have groups think about how each photo shows erosion. Once students have seen all the photos, ask them to think of a definition for erosion and write it on their whiteboard. Or, they can draw a picture to explain their idea.

NGSS - DCI: Weather and Climate: Natural Hazards

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- **Erosion** is the action of surface processes (such as water flow or wind) that removes soil, rock, or dissolved material from one location and then transports it to another location.
- Downpours cause a lot of erosion! Here in the Pacific Northwest, one of the impacts of climate change will be increased heavy **downpours**, so we need to get ready to act!
- Plants play an important role in helping prevent erosion! But sometimes there are no plants! Why wouldn't there be any plants- (show example picture? Then pair share) (Clear cuts, fires, bare rock, garden beds). **Plants need soil and soil needs plants.**

Activity

Duration: ~ 15 min.

Tell the students that today they will be creating their very own mountain community. Their job will be to protect their community from an upcoming storm! Their community must consist of a house on the top of the mountain, a house on the side of the mountain, and a house at the bottom of the mountain. Their houses will need to be connected by roads.

[NGSS – SEP: Developing and using models](#)

Since the mountain doesn't have any vegetation, it's highly prone to erosion. Students will need to use found materials in the garden to protect their mountain community.

[NGSS – CCC: Cause and Effect](#)

Demonstrate to students how to make a mountain out of soil and where they need to place their three houses and a few examples of ways they could be connected by roads. Give students boundaries for how far they can search for materials and what they are not allowed to use (i.e. no picking plants)

Give students 10-15 minutes to make their mountain community, then each mountain will be facing a "storm"! Tell the students that before the "storm" they will be presenting their erosion prevention strategy to the class and that each member of the group will need to explain one part of their strategy.

[NGSS – CCC: Stability and Change](#)

Guidelines:

- 3 houses-one on top, one on the side, one on the bottom of the mountain
- Houses must be connected by a road
- Set boundaries: materials and location

After 10-15 minutes gather students up in a big circle. Have groups present their designs one by one, then pour 250 ml of water on the mountain. Have students share observations for each one and make notes of what was observed for each one.

[NGSS - SEP: Constructing explanations and designing solutions](#)

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Closure

Duration: ~ 5 min.

Gather together as a whole class using magnetic toes and reflect:

1. What design did the best job at preventing erosion? Why?
2. Have pair share what design they thought was best.
3. If you could do this again, what new ideas would you try?
4. Have you ever seen an erosion prevention design in action?
5. Are there ways that erosion is prevented in nature?
 - Tree leaves that cover the ground in the fall
 - Introduce the concept of **mulching** (covering bare soil with leaves, straw, or other organic materials) and **cover crops** (plants grown to keep the soil together and often to add nutrients)

Extensions

Plant a cover crop with students (fava beans are a great choice as they have edible and tasty leaves) or show a cover crop already growing in the garden.

Walk around school grounds and look for signs of erosion or erosion prevention. Come up with strategies that would help prevent erosion to propose to school facilities.

Set up a rain gauge to record rainfall at the school. Having a multi-year project will help students understand how climate is different than weather.



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Next Generation Science Standards

Performance Expectation: Earth's Systems		
2-ESS2-1: Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.		
Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
<p>Developing and using models, constructing explanations and designing solutions</p> <p>Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1)</p>	<p>Earth's Materials and Systems (ESS2.A)</p> <p>The Roles of Water in Earth's Surface Processes (ESS2.C)</p> <p>Optimizing the Design Solution (ETS1.C)</p>	<p>Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.</p> <p>Stability and Change Students observe some things stay the same while other things change, and things may change slowly or rapidly.</p> <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Influence of Engineering, Technology, and Science on Society and the Natural World Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1)</p>

NGSS Lead States. 2013. [Next Generation Science Standards: For States, By States](#). Washington, DC: The National Academies Press.